WASTEWATER AND RECLAIMED WATER SYSTEM DESIGN

(PREVIOUSLY SEWER SYSTEM DESIGN)

Technical Design Manual #2

Chandler ✦ Arizona

January 2002

TECHNICAL DESIGN MANUAL NO. 2
WASTEWATER AND RECLAIMED SYSTEM DESIGN

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SECTION 1.0
POLICY

The City Engineer reserves the right to modify the requirements of this manual when special conditions justify it. Each development to be served with municipal sewer service shall be adjacent to a sewer line. The developer is required to install all of the sewer lines, service taps, manholes, and appurtenances within and adjacent to his development as determined by the City Engineer. All sewer line designs shall provide for sufficient capacities and depths to service all of the areas tributary to the development, along with the development itself.

A sewer system infrastructure analysis shall be required for proposed developments determined by the City Engineer to have a large impact on the sewer system. The developer of the property shall be responsible for all costs associated with the infrastructure analysis.

Under special conditions the City will accept a public sewer line on private property. All of the following conditions must be met:

1) The sewer line must serve property owned by more than one developer.
2) The sewer line must be in a dedicated easement.
3) The sewer line must meet City construction standards.
4) The City Engineer must determine that the acceptance of the sewer line benefits the City.

SECTION 2.0
DEFINITIONS

Appurtenance: Item attached to a main structure to enable it to function, but not considered an integral part of it.

Developer: Any person(s), corporation, partnership, or firm desiring municipal sewer, reclaimed water, and sewer service.

Interceptor, Trunk, or Main Sewer: A sewer line greater than 15 inches in diameter and tributary to an outfall sewer. It collects sewage from one or more laterals.

Lateral or Submain Sewer: A sewer line equal to or less than 15-inches in diameter and tributary to an interceptor or larger sewer. It collects sewage from two or more service taps.

Municipal Sewer Service: Sanitary sewer service provided for domestic, commercial, and industrial purposes.

Private Sewer Line: Any sewer line not owned and maintained by the City.

Public Sewer Line: A sewer line owned and maintained by the City.

Service Tap: A pipe that carries sewage from a point of collection, such as a building drain, to a public or private sewer line.

Sewer Service Area: A designated area from which sewage flows originate or contribute to the sewer system.

Outfall Sewer: The sewer line that conveys the sewage from interceptors to the final point of discharge or treatment.

SECTION 3.0
ENGINEERING REQUIREMENTS

3.1 STANDARD SPECIFICATIONS AND DETAILS

All standard specifications and details for sewer system design are located in the City of Chandler Standard Specifications and Details manual and the MAG Specifications and Details manual.

3.2 CONSTRUCTION MATERIALS

The City has adopted the requirements given in the MAG Standard Specifications with the modifications presented in the Standard Specifications and Details manual. In addition, the City has the following requirements:

1) Sewer lines 8 inches to 15 inches in diameter shall be Polyvinyl Chloride (PVC) SDR 35, or Extra Strength Vitrified Clay Pipe (VCP).

2) PVC pipe greater than 15" in diameter is not allowed.

3) Sewer lines greater than 15 inches in diameter shall be VCP, or PVC lined reinforced concrete pipe (RCP). All PVC lining systems shall cover the entire interior of the pipe, 360º lining, and be of a type approved by the City Engineer.

4) All sewer forcemains, exclusively, shall be Lined DIP.

5) Lined DIP may be used in lieu of the materials listed above when approved by the City Engineer. All installations of Lined DIP shall require submittals for consideration. The specification submittals shall include: manufacturer's lining specifications, references for owners of other similar projects, and a listing of a minimum of ten other similar applications.

6) All manholes shall be the precast type as detailed in MAG Standard Detail 420. All precast manholes on sewers 18 inches and larger in diameter or in arterial streets shall include T-Lock PVC lining in accordance with manufacturer's application details.

In addition, all design and installation details shall conform to the American Society for Testing Materials (ASTM) standards and to the manufacturer's recommended standards. If conflicts occur between any of the standards, the most conservative standard will govern; except where the MAG or City Standards specifically address the topic.

3.3 SEWER LINE DESIGN

All sewer lines shall be designed in accordance with the current City Wastewater Master Plan. The current City sewer line design requirements are as follows:

1) All sewer lines shall be a minimum of 8-inches in diameter with a minimum cover of 4 feet.

2) All sewer taps shall be the wye type and sized as specified in Table 3, page 11 of this manual. All connections to existing sewer mains shall be accomplished by machine tapping, utilizing a saddle, or by construction of a manhole. Taps larger than 8 inches shall be installed directly into a manhole with no more than four taps in a single manhole. An inspection manhole shall be installed on any service tap or private sewer line when determined necessary by the City Engineer. Water Quality Department shall determine if a sampling manhole is required.

3) Direct service taps may not be installed on 15-inch and larger sewers. However, a manhole may be constructed on an interceptor or larger sewer, and then a lateral sewer line may be installed. The lateral sewer line extension will terminate upstream in a manhole. Direct service taps then may be installed on the upstream lateral.

4) All sewer taps should be 4 1/2 feet deep at property line. To raise the tap from the mains deeper than six feet, the wye and 1/8 bend shall be set at a 45º angle from horizontal and a short piece of straight pipe shall be placed on the 1/8 bend. Another 1/8 bend is placed at the other end of the short pipe to bring the tap to appropriate grade at the property line.

5) A manhole is required wherever the sewer changes grade, size, alignment, intersects another sewer or ends. Where sewer lines of differing sizes enter the same manhole, the smaller sewer lines shall not have their crowns lower than the crown of the largest pipe. All manholes shall have sewer intersections between 90º and 180º inclusive. Manholes with sewer lines intersecting at angles between 90º and 120º shall have a minimum 0.10-foot drop across the manhole. In interceptor and larger sewers, inverts at junctions shall be designed to maintain the energy gradient across the junction and to prevent backflow.

6) The maximum allowable manhole spacing is 400 feet for sewer lines between 8 inches and 15 inches in diameter. Sewers 18 inches in diameter and greater shall have manhole spacing of 600 feet. A cleanout may be installed in lieu of a manhole at the end of a lateral sewer provided that the distance from the cleanout to the nearest manhole does not exceed 150 feet.

7) For all sewer lines with an invert depth greater than 10 feet, 5-foot diameter manholes with 30-inch diameter covers are required. For all other installations, 4 foot diameter manholes with 24-inch diameter covers may be used. All manhole frames and covers shall be adjusted per MAG Standard Detail 422, except when outside of pavement, in which case it shall be adjusted per City of Chandler Specification 2. All manholes on sewers 18 inches and larger or located within arterial streets shall have T-Lock PVC Linings. Steps shall be included in manholes of 10 feet in depth or less. All manhole interiors shall be painted with "Insecta Insecticidal Coating - White Semi-gloss Latex" or approved equal.

8) Pipe bedding shall conform to MAG specifications. Pipe installation shall conform to the City of Chandler Standard Detail C-402.

9) All sewer lines shall be designed to provide a minimum velocity of 2.0 feet per second and a maximum velocity of 10.0 feet per second based on full flow and Manning's equation with a minimum roughness coefficient, "n" factor, of 0.013 for all pipe materials. The minimum slope requirement for eight (8) inch diameter sewers to terminal reaches shall be 0.52% to maintain a velocity of 2.5 feet per second based on full flow pipe conditions. The length of 8" line at the 0.52% slope shall be from the trunk line to the point of first confluence.

10) All sewers shall be vactored (or approved equal) and inspected for debris and video taped prior to final acceptance. Pipe deflections greater than one inch shall not be allowed. Video tapes shall be submitted to the City wastewater collections department. Manholes are to be vacuum tested per ASTM C1244-93, standard test method for concrete sewer manhole by negative air pressure.

3.4 SEWER LINE LOCATIONS

All public sewer lines shall be placed in either the public right-of-way or in a dedicated easement. The minimum easement width is 12 feet, with the entire easement free of property lines, boundary walls and other obstructions for its entire length and width. The standard location for sewer lines within the public right-of-way is in the center of a driving lane on the south and west side of the street as shown in the Standard Specifications and Details manual. Generally, sewer lines shall only be permitted to cross and re-cross the street centerline for short distances, providing that the sewer line maintains a clear distance of 3 feet or more from the lip of gutter on the south and west side of the street. Encroachment of more than 4 feet past the street centerline will generally not be allowed. The minimum separation between sewer and water lines shall be 6 feet horizontally and 2 feet vertically. All sewer service connections shall be extended a sufficient distance beyond street right-of-way lines to clear all facilities to be installed in public utility easements which parallel the street right-of-way.

3.5 PRIVATE SEWER LINE DESIGN REQUIREMENTS

Private sewer lines are not allowed within the right-of-way or utility easements. All manholes on private sewers shall have covers stamped to read "Private Sanitary Sewer".

Per City Code all sewer lines 8 inches in diameter and larger are deemed to be off-site improvements. Therefore, private sewer lines 8 inches in diameter and larger are subject to all of the requirements listed in this manual and are not governed by the Uniform Plumbing Code. In addition, private sewer lines 8 inches in diameter and larger are required to include a plan and profile. All private sewer lines less than 8 inches in diameter are governed by the Uniform Plumbing Code. The following variances to this design manual are permitted for private sewer lines.

1) Any construction materials allowed under the Uniform Plumbing Code are permitted. HDPE (High Density Polyethylene Pipe) is not permitted in the City of Chandler.

2) Cleanouts installed at intervals not to exceed 300 feet are permitted in lieu of the manhole spacing requirements given in Section 3.3 of this manual. The cleanout spacing requirements are given in Section 406 of the Uniform Plumbing Code.

For completeness, the requirements given in the Uniform Plumbing Code shall apply to all situations not specifically covered by this manual.

3.6 RECLAIMED WATER LINE DESIGN REQUIREMENTS

The current city reclaimed water line requirements are as follows:

1) All reclaimed water lines shall be installed in locations per City of Chandler Standard Detail C-200, C-201 and C-202 unless otherwise determined by the City Engineer.

2) A minimum of 6 feet separation is required between reclaimed water and sewer lines a minimum of 6 feet separation is required between reclaimed water and potable water lines.

3) All reclaimed water line construction shall be in accordance with City of Chandler Standard Specifications and Details.

4) Public reclaimed water lines shall be 12 inches in diameter unless otherwise indicated in the City's Reclaimed Water Master Plan.

5) Tees shall be spaced at a distance no greater than 1/4-mile. Crosses shall be installed at the intersection of arterial streets.

6) All laterals shall be a minimum of 8 inches in diameter. Laterals shall extend past the edge of existing pavement.

7) Two valves shall be required on each tee and three valves shall be required on each cross.

8) Valve box installations shall conform to City of Chandler Standard Detail C-406 and C-318. In areas subject to wheel loading, valve box installations shall also conform to City of Chandler Standard Detail C-317.

9) No valves shall be located in sidewalk or ramp areas. All valves must be stationed on the plans.

3.7 MISCELLANEOUS REQUIREMENTS

Curved sewer lines are allowed, with approval, provided that the radius of the curvature is not less than 500 feet. Television camera inspection at developer expense is required of all curved sewers.

Construction of sewer lines is not allowed under retention basins without permission from the City Engineer. Should construction under a retention basin be allowed a concrete cap shall be installed over the sewer.

Service taps may be connected to the manholes on the sewer line. All abandoned sewer service taps shall be capped.

Sewer lines constructed near or adjacent to irrigated areas or retention basins must have water-tight manhole covers as per MAG Standard Detail 423.

Developers of commercial and industrial projects are required to complete a Wastewater Discharge Questionnaire.

Metallic, detectable warning tape shall be required at all locations. The tape shall be placed one foot above the top of pipe (maximum depth 4 feet) and shall be shown on as-built plans. All plastic pipe with a curved alignment shall be identified with 3-inch wide metallic, detectable warning tape with the word “sewer” or “wastewater” emblazoned thereon. The tape shall be installed 12 to 18 inches below the ground surface over the entire length of the pipe.

Wastewater meters are installed for commercial or industrial projects that consume large quantities of water, as determined by the City Engineer, thereby reducing monthly sewer charges.

For sewers constructed in arterial streets, the minimum size for stub-outs at the one-half and one-quarter section lines is 12 inches in diameter. All other stub-outs shall be a minimum of 8 inches in diameter.

For locations of utilities in streets, see City of Chandler Standard Details Number C-200, C-201, and C-202.

When sewage flow approximations are necessary the values given in Tables 1 and 2 shall be used, unless more accurate information is available.

Sewer lines are required within half streets when the south or west one-half is being constructed, providing that a tributary area exists. The tributary area can either be the development itself or a separate sewer service area that is sewered through the development. To minimize street cuts, every manhole in undeveloped areas shall have stub-outs beyond the street right-of-way.

If a model home area is a part of the development project, sewer lines must, as a minimum, be constructed from the point of out fall up to and including the first manhole upstream from the model area.

In the case of phased development, each successive phase shall provide sufficient sewers to service all of the areas tributary to the phase.

Sewage pump stations shall conform to the requirements of ADEQ Engineering Bulletin No. 11, Chapter IV, C.2 Design Flows for calculating the peaking factors for low volume flows based on population. All sewage pump station wet wells shall include approved coatings. Pump stations are not allowed without approval of the City Engineer.

TABLE NO. 1

WASTE WATER SERVICE FACTORS
CITY OF CHANDLER, ARIZONA

Type of Service	Average Daily Flow (gallons/person)	Peak Daily Flow (gallons/person)	Peak Factor
Domestic Use	100	195	3.0

Type of Service	Average Daily Flow	Units
Theater	5	gallons/seat/day
Retail	1	gallon/square foot/day
Restaurant	30	gallons/day/seat
Hotel/Motel	130	gallons/room/day
Schools (with lunch & shower facilities)	75	gallons/student/day
Schools (without lunch & shower facilities)	50	gallons/student/day
Other	100	gallons/person/day
Industrial & Commercial	1300	gallons/acre/day

TABLE NO. 2

POPULATION FACTORS
CITY OF CHANDLER, ARIZONA

Type	Number of People/Dwellings
Single Family (SF)	3.3
Patio Homes (PH)	3.1
Multi-Family (MF)	2.8
Mobile Homes (MH)	2.4

Note: The maximum number of dwellings in a square mile section is 3,000.

TABLE NO. 3

MINIMUM SERVICE TAP SIZES
CITY OF CHANDLER, ARIZONA

Type	Pipe Size (inches)
Residential	4
Multi-Family	6
Industrial	6
Commercial	6

SECTION 4.0
PLAN REQUIREMENTS

All off-site construction plans shall be prepared and signed by a professional engineer who is qualified and registered by the State of Arizona to practice in a particular field of competency required by the type of improvements.

Plans shall be submitted on 24" x 36" sheets. The plans shall be drawn to an engineering scale with 1" = 20' and 1" = 40' as the preferred horizontal scales. The vertical scale need not differ from the horizontal scale by a precise factor of 10. Water, sewer and paving plans may all be shown on the same plan sheets, if a horizontal scale no smaller than 1" = 20' is used.

All sewer lines and utility crossings shall be shown in both plan and profile views.

All elevations shown on the plans shall be referenced to a benchmark on the City datum unless otherwise approved by the City Engineer.

The engineer shall obtain a copy of the latest Sewer Notes and Sewer Plan Review Checklist from the Development Services Department.

The following requirements apply to all sewer and reclaimed water line plans:

1) The name of the proposed development must be shown on the cover sheet.

2) The developer's name, address, and phone number must be shown on the cover sheet.

3) The engineer's name, address, and phone number must be shown on the cover sheet.

4) A vicinity or site location map is needed on the cover sheet.

5) An index map with the following information is needed on the cover sheet:

    a) Existing sewer system.
    b) Proposed sewer system.
    c) Pipe sizes.
    d) Sheet numbers.
    e) Direction of flows.
    f) Phase limits and numbers if applicable.
    g) Model home phase.

6) The following notes, if applicable, are required on the cover sheet:

a) The outfall sewer line to be constructed and accepted with this subdivision phase passes through phases which will be completed at a later date. Suitable measures shall be taken to prevent debris from entering the sewer once it is in use.

b) Prior to pavement subgrade preparation on subsequent phases, the outfall sewer shall be plugged at the first downstream manhole. Upon completion of paving the outfall sewer shall be vactored to prevent debris from entering the existing system and reinspected for debris prior to acceptance.

7) The following approval block shall be on the cover sheet:

a) For Capital Improvement Projects:

APPROVED:

_____

DIRECTOR OF PUBLIC WORKS DATE

_____

CITY ENGINEER DATE

b) For all other projects:

APPROVED FOR COMPLIANCE WITH CITY CODE:

_____

CITY ENGINEER DATE

_____

PUBLIC WORKS ENGINEER DATE

8) The following approval block, with signature, shall be on the cover sheet:

SANITARY SEWER AND RECLAIMED WATER APPROVED:

_____

MARICOPA COUNTY DATE
ENVIRONMENTAL SERVICES DEPARTMENT

9) The following current City standard notes must be shown on the cover sheet:

a) General notes.
b) Sewer notes.
c) Water notes (if reclaimed waterlines are shown on the plans)

10) Plans must be coordinated with all of the appropriate utility companies on the list below. A "utility coordination block" is required on the cover sheet indicating the names of the utility companies and the date plans were submitted to them.

Salt River Project (Power)
Salt River Project (SRVWUA)
Arizona Public Service
U.S. West Communications
COX Cable
Southwest Gas
El Paso Natural Gas
Southern Pacific Gas
Sprint Telephone Long Distance
AT&T Telephone Long Distance
Air Products and Chemicals, Inc.

11) All elevations shown on the plans must be referenced to an approved City benchmark. The City's Benchmark ID Number (CMCN#) and verbatim description must match the latest edition of "City of Chandler Vertical Control Base List", and must be shown on the cover sheet.

12) If the development is adjacent to a current City Project/Improvement District, plans must be coordinated with the City Project/Improvement District Engineer. The following approval block (with signature) shall be shown on the cover sheet.

_____

APPROVED FOR COORDINATION DATE
(Project name and number)

13) If a portion of the improvements shown on the plans are within the jurisdiction of the State/County, acquire the appropriate permit. Indicate the permit number on the cover sheet.

14) Provide a quantity tabulation on the cover sheet; see the Certificate of Quantities list for the required items.

15) A service tap detail is required on the cover sheet showing the following items:

a) Standard tap location.
b) Minimum 6-foot separation between water and sewer taps.
c) Standard detail number.

16) A manhole service tap detail shall be shown on the cover sheet.

17) The following shall be shown on the lower right of the cover sheet over the title block:

C. O. C. Log No. _____

18) The minimum height of all text and lettering shall be 0.1 inch (one-tenth of one inch).

19) The scale must be shown on each sheet.

20) North arrows must be shown on each sheet.

21) All existing sewer lines being tied into must be shown in both plan and profile views.

22) All proposed sewer lines must be shown in both plan and profile views.

23) All match lines must be shown in profile. Station numbers are also required.

24) Phase limits and numbers must be shown on all applicable sheets.

25) Dimensional ties must be provided for all existing sewer lines being tied into. This requirement is usually satisfied by providing both a station number and dimensional ties to the street centerline.

26) The following items must be noted on the plans:

a) Rim elevations on existing manholes.
b) Rim elevations on proposed manholes to nearest tenth.
c) Invert elevations on existing manholes.
d) Invert elevations on proposed manholes.
e) Station numbers on existing manholes.
f) Station numbers on proposed manholes.
g) Dimensional ties from the street centerline to existing manholes.
h) Dimensional ties from the street centerline to proposed manholes.
i) Distance between manholes.
j) Distance between manholes and cleanouts.
k) Standard detail number for manholes and cleanouts.
l) Bearings on street centerlines.